Abstract:
Investigate and implement algorithms and strategies for automated trading in financial markets.

Analysis of Existing Strategies:
For each pair of technical strategies, we ran multiple PXS simulations (using the symmetric background agent), recorded their results, and graphed their performance throughout the day. The specific numerical results are included in the appendix, as is a single testing of the market making strategy versus the other strategies. This is a summary of our findings:

![Image](image1.png)

We implemented this strategy and modified the liquidation process, which, during the last half hour, attempts to return the long/short position to 0. Below are our results, compared with the other group’s results, for the competition in December.

Developments of Dynamic Market Making Strategy:
Market Maker was by far the most successful strategy, so we did further research on this strategy.

An ideal scenario for a market-making agent would have the exact same number of buy and sell orders filled, resulting in the fluctuation of a long and short position, centered around zero. But this does not always work out in practice. If, for example, a stock price is going up consistently, the ask price gets hit more often than the bid.

This can result in the accumulation of a large short position in the rising stock. The opposite scenario can also occur and is equally as negative. We attempt to mitigate the inventory effects by dynamically resizing the spread according to the following formula:

- Spread = MinimumDistance + alpha * max(0, Inventory-InitialLimit)

The two main parameters, for which we needed to determine optimal values, are alpha (the degree of pressure we put on the on the ask/buy prices to change) and InitialLimit (the inventory size at which the prices will start to be affected). After testing different values for these two parameters, we were able to find what seems to be experimentally optimum values.

We used the “before penalty” values because seven of the eight competing groups had anomalies within the “after penalty” results, most likely due to liquidation problems.

Some of the positive results we found for our strategy (excludes asymmetric background simulations):

- The highest average value and a competitive Sharpe Ratio when run along with the given strategies and the symmetric background agent.
- By far the best Sharpe Ratio when run using historical data.
- A positive and somewhat competitive value when run along with all the other groups strategies.

Conclusion:
Overall, we have a somewhat un-impressive Sharpe Ratio of 0.74, but are somewhat close to the highest Sharpe Ratio of 0.85. Our second highest average value of $4436 is 40% greater than the two strategies with higher Sharpe Ratios, but 33% less than that of the leader in this category, who had the fourth highest Sharpe Ratio, at 0.68.

In a less risk-averse assessment (based more on average gain and less on volatility) the latter of these strategies along with our strategy, would be higher valued than the other strategies.